

Understanding Primary Care Provider Attitudes and Behaviors Regarding Cardiovascular Disease Risk and Diabetes Prevention in the Northern Midwest

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■ IN BRIEF We sought to fill critical gaps in understanding primary care providers' (PCPs') beliefs regarding diabetes prevention and cardiovascular disease risk in the prediabetes population, including through comparison of attitudes between rural and non-rural PCPs. We used data from a 2016 cross-sectional survey sent to 299 PCPs practicing in 36 primary clinics that are part of a randomized control trial in a predominately rural northern Midwestern integrated health care system. Results showed a few significant, but clinically marginal, differences between rural and non-rural PCPs. Generally, PCPs agreed with the importance of screening for prediabetes and thoroughly and clearly discussing CV risk with high-risk patients.

In 2015, an estimated 84.1 million adults aged 18 years and older, or 33.9% of the U.S. adult population, met the criteria for prediabetes according to A1C level and fasting glucose data (1). However, roughly 9 in 10 of these adults did not know they had prediabetes (1) and were probably unaware that they could take several steps to reduce their risk of developing type 2 diabetes. The situation is likely exacerbated in rural areas, where diabetes incidence is about 17% higher than in urbanized regions (2). Also, compared with urban communities, rural communities continue to have higher rates of coronary heart disease (3), the foremost cause of death for adults in the United States (4).

Like people with diabetes (1,5,6), individuals with prediabetes are at an increased risk for cardiovascular (CV) disease (7), potentially because of numerous biological pathways (5). The task of identifying patients with prediabetes, preventing diabetes onset, and assessing CV risk falls heavily on primary care providers (PCPs), who typically treat patients

with multiple chronic conditions. However, current fee-for-service or visit payment models used in primary care (8), which value quantity over quality (9), as well as the competing demands of providing acute, patient-centered, and evidence-driven care and preventive services (10,11), can mean that PCPs have limited time to address disease prevention with individual patients. Short patient visits may make diagnosis and effective management of multiple chronic conditions more difficult for PCPs. Addressing diabetes prevention is also uncommon in clinical practice (12). The scarce resources, including available PCPs (13), of many rural primary care clinics exacerbate the problems pervasive in primary care settings and can further decrease time spent on preventive care. Research suggests that more effective use of the electronic medical record (EMR) may facilitate the identification of prediabetes and diabetes prevention (14). However, little is known about how it could help support the identification and management of prediabetes and increased CV risk, especially in the

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context of clinical decision support (CDS) and shared decision-making, key components of the chronic care model (15,16).

The body of knowledge about PCPs' perceptions regarding prediabetes and CV risk is limited. A 2006 national survey of 888 PCPs found that, although many PCPs selected the recommended guidelines in practice case vignettes, care choices were not consistently made based on the latest CV risk guideline recommendations (17). Significant differences in guideline use were seen based on PCP characteristics and practice, where individuals who had practiced ≤ 10 years and individuals with case-loads composed of $\leq 25\%$ patients with hypertension and dyslipidemia were most likely to adhere to recommended CV risk guidelines (17). However, although some research has assessed PCP attitudes toward diabetes (18–20), few studies have focused on PCP attitudes about diabetes prevention, prediabetes, or its relationship with CV risk.

Objectives and Hypotheses

The purpose of this research was threefold: 1) assess PCP knowledge, attitudes, beliefs, shared decision-making, and experience in the prevention and management of CV risk factors in patients with prediabetes; 2) determine PCP opinions on currently available clinic resources, prevention strategies, and EMR-driven CDS related to CV risk and/or diabetes prevention; and 3) test the hypothesis that differences in PCP attitudes and opinions exist based on level of clinic rurality.

Research Design and Methods

Study Population

We invited all 299 physician, nurse practitioner, and physician assistant PCPs practicing in 36 Essentia Health primary care clinics in Minnesota, North Dakota, and Wisconsin to take part in a cross-sectional survey. These 36 clinics are included in a randomized control trial of an EMR-

based CV CDS tool, which will be reported on separately. No compensation was provided for taking part. The survey reported here was administered pre-intervention. Exclusion criteria included survey non-response and PCPs who reported seeing patients in these clinics 0 days per week or were missing data on this question.

Essentia Health is a nonprofit integrated health care system with 75 clinics and 15 hospitals spanning four northern Midwestern states (Minnesota, Wisconsin, North Dakota, and Idaho). Essentia Health employs >900 physicians and 1,000 advanced practitioners in primary and specialty care serving a geographic service area classified as 83.8% rural, with a population base of 2 million people, of whom 56.2% live in a rural area and 45.2% live in an area with a health professional shortage (21). This practice setting presents a unique opportunity to gauge PCP attitudes toward diabetes and CV disease prevention, as well as make comparisons between rural and non-rural practitioners regarding these beliefs.

Data Collection

Eligible PCPs were emailed notifications about taking part in the electronic survey by Essentia Health's primary care leadership. An initial email survey request was then made, followed by as many as seven reminder notifications, including a second email from the primary care leader with the fifth reminder notification. Survey completion implied PCP consent. The survey was administered through REDCap (Research Electronic Data Capture) (22) by the Survey Research Center at HealthPartners Institute. This study was approved by Essentia Health's institutional review board.

Instrument

The survey contained measures addressing PCP demographics, experience, prediabetes care, CV risk factor management, use of CV risk calculations, shared decision-making

behaviors, and EMR decision support usability, including items adapted from two previously validated scales, the Shared Decision Making Questionnaire—physician version (SDM-Q-Doc) (23) and the System Usability Scale (SUS) (24). The SDM-Q-Doc was selected because it is designed specifically for providers and required little modification for focusing on CV risk; the SUS was chosen because of its adaptability, with only the system name needing modification. This article focuses on PCP attitudes about prediabetes, CV risk, shared decision-making, available clinic resources, prevention strategies, and current EMR decision support.

The SDM-Q-Doc gives a score of 0 to 100, representing the minimum (0) to maximum (100) levels of shared decision-making (23). We adapted the six response categories on the SDM-Q-Doc into five categories (“strongly disagree,” “disagree,” “neither agree nor disagree,” “agree,” and “strongly agree”) and addressed this change by normalizing the scale to range from 0 to 100. Questions on the current EMR adapted from the SUS included the following responses: “strongly disagree,” “somewhat disagree,” “neither agree nor disagree,” “somewhat agree,” and “strongly agree” (24). SUS scoring ranges from 0 to 100, with 100 representing the highest degree of system usability (24). The SUS does not have specific cutoffs; rather, it can be used to compare one system's usability with another, under the assumption that higher scores equate to greater usability.

Data Analysis

Data were analyzed using descriptive statistics and nonparametric tests of association. Two-tailed χ^2 cross tabulations and Wilcoxon rank sum independent group t tests for non-normally distributed continuous data were used to assess significant subgroup differences in PCP responses based on level of clinic rurality. Specifically, numeric clinic rural-urban commuting area

(RUCA) codes were initially combined into four categories: metro, micro, rural, and small (25). We dichotomized these categories as “metro/micro” (referred to in this article as “non-rural”) and “rural/small” (referred to as “rural”) for subgroup analysis. Five-category Likert responses were also condensed for cross-tab analyses, such that “strongly disagree/(somewhat) disagree/neither agree nor disagree” = 0 and “strongly agree/(somewhat) agree” = 1, because there were less than five responding PCPs in some categories of clinic rurality. We used a 95% CI and corresponding $P < 0.05$. Analyses were conducted in SPSS 23 (IBM Corp., Armonk, N.Y.) (26).

Results

Of the 299 PCPs emailed an invitation to take part in the survey, 183 responded, giving a 61% response rate. PCPs took, on average, 12 minutes (SD 7.6) to complete the survey. Two of the 183 PCPs had since left the study clinics, and 7 were missing data on number of days practiced in the clinic, leaving a full sample of 174 PCPs for this study. Most respondent PCPs (60%) were women, and 41% practiced in rural or small-town clinics. Additional PCP demographics, including for non-respondents, are presented in Table 1.

Attitudes About Prediabetes and CV Risk

As shown in Table 2, on a scale from 0 to 10, PCP respondents reported discussing diabetes prevention with their patients much of the time (mean 6.72, SD 2.17). Most also felt prepared to discuss metformin and glucose medications (mean 7.13, SD 2.45) and dietary and physical activity recommendations (mean 8.43, SD 1.47) for prevention of diabetes and reduction of CV risk. PCP respondents overwhelmingly endorsed the importance of screening adult patients at risk for prediabetes (mean 8.97, SD 1.38).

Non-rural PCP respondents (mean 7.00, SD 2.13) had a higher frequency of discussing diabetes

TABLE 1. PCP Demographics for Survey Respondents and Non-Respondents

	Respondents (n = 174)	Non-Respondents (n = 116)
Age range (years)		
≤34	29 (17)	NA
35–44	38 (22)	NA
45–54	28 (16)	NA
55–64	38 (22)	NA
≥65	12 (7)	NA
Missing	29 (17)	NA
Clinic RUCA code		
Metro	66 (38)	34 (29)
Micro	37 (21)	20 (17)
Small town	38 (22)	36 (31)
Rural	33 (19)	26 (22)
Days/week seeing patients		
1	4 (2)	NA
2	8 (5)	NA
3	29 (17)	NA
4	73 (42)	NA
5	60 (35)	NA
Provider type		
Nurse practitioner	52 (30)	33 (28)
Physician assistant	24 (14)	15 (13)
Family practice physician	77 (44)	54 (47)
Internal medicine physician	21 (12)	14 (12)
Race		
American Indian	4 (2)	0 (0)
Asian	5 (3)	4 (3)
Black	3 (2)	0 (0)
White	157 (90)	108 (93)
Unknown	5 (3)	4 (3)
Sex		
Female	104 (60)	61 (53)
Male	64 (37)	52 (45)
Missing	6 (3)	3 (3)
Years in practice		
<1	11 (6)	NA
1–5	40 (23)	NA
6–10	31 (18)	NA
≥11	91 (52)	NA
Missing	1 (<1)	NA

Data are n (%). Count data are shown. Percentages are rounded to the nearest percentage point. Percentages may not add up to 100% because of rounding. NA, not available.

TABLE 2. PCP Full Sample and Subgroup Mean Responses on 0–10 Scaled CV Risk and Diabetes Prevention Items

Survey Questions	Response Ranges		Full Sample				Subgroup Comparison					
	0	10	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	Z	P
			Rural PCPs		Non-Rural PCPs		Difference					
At typical clinic visits for non-acute illnesses, how often do you discuss prevention of diabetes with your patients?	Never	Always	173	6.72 (2.17)	71	6.31 (2.18)	102	7.00 (2.13)			-2.03	0.042*
At typical clinic visits for patients with prediabetes, how well prepared do you feel to discuss the use of metformin or other glucose-lowering medications for preventing diabetes or reducing CV risk?	Not prepared	Extremely prepared	174	7.13 (2.45)	71	7.10 (2.24)	103	7.16 (2.60)			-0.692	0.489
At typical clinic visits for patients with prediabetes, how well prepared do you feel to discuss dietary and physical activity recommendations for preventing diabetes or reducing CV risk?	Not prepared	Extremely prepared	172	8.43 (1.47)	71	8.23 (1.29)	101	8.57 (1.58)			-2.32	0.020*
How important do you feel it is to screen adult patients at risk for prediabetes?	Not at all important	Extremely important	174	8.97 (1.38)	71	8.62 (1.52)	103	9.20 (1.22)			-2.79	0.005**
At typical clinic visits for non-acute illnesses, how often do you discuss CV risk reduction with your patients?	Never	Always	174	7.33 (1.71)	71	6.85 (1.68)	103	7.66 (1.65)			-3.12	0.002**
At these typical clinical visits, how easy is it to follow aspirin guidelines to determine if a patient will benefit from taking aspirin for primary prevention (e.g. USPSTF recommendations)?	Not at all easy	Extremely easy	172	5.94 (2.60)	70	5.71 (2.42)	102	6.10 (2.72)			-1.04	0.297

*P <0.05, **P <0.01. USPSTF, U.S. Preventive Services Task Force.

prevention with patients than rural PCPs (mean 6.31, SD 2.18) ($Z = -2.03, P = 0.042$) (Table 2). Although no statistically significant difference was seen between the two groups on preparedness to discuss metformin or glucose medications for diabetes prevention or CV risk reduction, non-rural PCPs (mean 8.57, SD 1.58) felt slightly more prepared to discuss dietary and physical activity recommendations than rural PCPs (mean 8.23, SD 1.29) ($Z = -2.32, P = 0.020$). Furthermore, non-rural PCPs (mean 9.20, SD 1.22) gave more importance to screening adult patients for prediabetes than did rural PCPs (mean 8.62, SD 1.52) ($Z = -2.79, P = 0.005$).

Attitudes About CV Risk and Shared Decision-Making

PCP respondents tended to report that they discussed CV risk reduction with their high-risk patients at a typical clinic visit for non-acute illnesses (mean 7.33, SD 1.71) (Table 2). A variety of CV risk calculation methods were reported by all 174 PCP respondents, including estimating patients’ CV risk themselves (6%) or using a smartphone-driven calculator (19%), a link within the EMR (56%), a Web-driven calculator (8%), another method (1%), or none (10%) (data not compared between rural and non-rural providers). However, the ease with which providers followed the U.S. Preventive Services Task Force aspirin guideline recommendations in determining patient benefit was mixed (mean 5.94, SD 2.60) (Table 2).

With regard to shared decision-making with high-CV risk patients, PCPs agreed or strongly agreed with the SDM-Q-Doc measures, ranging from 70% for thoroughly weighing different treatment options with patients to 89% for telling the patient about different options for reducing CV risk (Table 3). Overall, PCPs had a mean SDM-Q-Doc score of 75.56 (SD 14.43).

When compared with rural PCP respondents (mean 6.85, SD 1.68),

non-rural PCP respondents (mean 7.66, SD 1.65) had a significantly higher level of agreement with the statement that they discussed CV risk reduction with their high-risk patients at typical clinic visits for non-acute illnesses ($Z = -3.12$, $P = 0.002$) (Table 2). No other statistically significant difference was seen on other CV risk or shared decision-making attitudes between rural and non-rural PCPs (Table 3). Furthermore, no meaningful difference in SDM-Q-Doc scores was found between rural (mean 75.63, SD 13.15) and non-rural (mean 75.51, SD 15.31) PCPs ($Z = -0.16$, $P = 0.869$).

Attitudes About Clinic Resources and Current EMR-Driven CDS

Most PCPs (68%) reported that clinic visit times were often too short to discuss CV risk factor care with their patients at high risk for CV disease and diabetes (Table 4). Opinions varied on whether resources were too tightly limited to improve CV risk factor care. PCP responses regarding current EMR decision support for CV risk assessment and management were also variable. For example, opinion was split on whether the current EMR decision support was too cumbersome/awkward to use to help manage a patient's CV risk. Although most PCPs (78%) agreed that they would like to use the EMR decision support more often to help patients better manage CV risk, only 41% somewhat agreed or strongly agreed that they felt confident using it in this manner. On a scale from 0 to 100, the mean SUS score was 53.27 (SD 17.10), which suggests that the usability of the current EMR decision support related to CV risk management could be enhanced for PCPs. Of note, when the effect of level of rurality was examined for these dichotomized items, no significant difference was seen between groups on any item. Furthermore, no significant difference was seen in SUS scores between rural (mean 53.11, SD 16.19) and non-rural (mean

53.38, SD 17.80) PCPs ($Z = -0.24$, $P = 0.807$).

Clinic Diabetes Prevention and CV Risk Factor Strategies

As shown in Table 5, most PCPs did not perceive their clinic as using the listed diabetes prevention and CV risk factor strategies, although there were exceptions. The most commonly used CV risk factor care strategies included the following: reported measurements of provider or clinic performance for CV risk factor outcomes (74%, with 45% stating it worked well and 29% stating that it did not); guideline-driven reminders for services the patient should receive that appear when seeing the patient (62%, with 34% stating it worked well and 28% stating that it did not); and a systematic approach to identify and remind patients at high risk for diabetes or CV disease who are due for health services (56%, with 38% stating it worked well and 18% stating that it did not). Regarding the components of care management routinely provided to patients at high risk for developing diabetes or CV disease, most PCPs reported the following: reviewing and individualizing the care management plan with patients (52%, with 29% stating it worked well and 23% stating that it needed improvement); helping patients set individualized treatment goals (58%, with 28% stating it worked well and 30% stating that it needed improvement); reviewing the patient's history of targeted clinical measurements over time (e.g., blood pressure, LDL cholesterol, A1C, weight) (86%, with 58% stating it worked well and 28% stating that it needed improvement); and providing individualized patient education and support (55%, with 30% stating it worked well and 25% stating that it needed improvement).

When examining differences between the three response options and level of rurality, rural and non-rural providers only differed significantly on routinely helping patients who are at high risk for

diabetes or CV disease set individualized treatment goals: $\chi^2 = 6.339$, ($df = 2$, $n = 145$), $P = 0.042$ (Table 5). Differences appear to exist between subgroups on opinions for individuals who do provide this assistance, where 36% of rural providers reported that doing so worked well, whereas only 21% of non-rural providers said the same (not shown). Similarly, 37% of non-rural providers responded that providing this assistance with treatment planning for these high-risk patients needed improvement, compared to 20% of rural providers. No other significant difference was seen between rural and non-rural PCPs on the items in Table 5.

Conclusions

Few studies have examined PCPs' attitudes about CV disease and diabetes prevention in primary care practice, although some have addressed PCP attitudes and beliefs regarding CV risk (17) and diabetes (18–20). We expand this body of knowledge by assessing PCP attitudes and shared decision-making for managing CV risk and engaging in diabetes prevention with their patients, as well as evaluating PCP perceptions of current clinic resources, prevention strategies, and EMR-driven CDS in Essentia Health, a large, predominantly rural northern Midwestern integrated health care system. Our findings show that PCPs generally reported placing a high level of importance on diabetes prevention, screening for prediabetes, and assessing patients' CV risk in a patient-centered manner. However, clinic visit time was generally described as too short to discuss CV risk factor care, similar to findings by Doroodchi et al. (17). Opinions varied on the availability of clinic resources related to CV risk factor care, the cumbersome nature of the current EMR decision support, and prevention strategies. Furthermore, although PCPs wanted to use EMR-based decision support when managing patients' CV risk, few reported feeling confident in doing so. These findings

TABLE 3. PCP Attitudes on Addressing Patients With High CV Risk at a Recent Office Visit With Regard to Shared Decision-Making: Full Sample and Subgroup Differences

Survey Questions	n	Full Sample					Subgroup Comparison					
		Response Options					Rural PCPs		Non-Rural PCPs			Difference
		Strongly Disagree, n (%)	Disagree, n (%)	Neither Disagree nor Agree, n (%)	Agree, n (%)	Strongly Agree, n (%)	n	Mean (SD)	n	Mean (SD)	χ^2	
Shared decision-making*												
I made clear to my patient that a decision about reducing CV risk needs to be made.	172	1 (<1)	4 (2)	20 (12)	102 (59)	45 (26)	70	4.07 (0.71)	102	4.09 (0.73)	0.267	0.605
I wanted to know exactly from my patient how he/she wants to be involved in making that decision.	172	1 (<1)	6 (3)	30 (17)	100 (58)	35 (20)	70	3.99 (0.73)	102	3.91 (0.77)	0.604	0.437
I told my patient that there are different options for reducing his/her CV risk.	171	1 (<1)	0 (0)	17 (10)	103 (60)	50 (29)	69	4.14 (0.63)	102	4.20 (0.66)	0.778	0.378
I precisely explained the advantages and disadvantages of treatment options to my patient.	172	2 (1)	5 (3)	32 (19)	94 (55)	39 (23)	70	3.94 (0.83)	102	3.95 (0.78)	1.133	0.287
I helped my patient understand all the information about ways to reduce CV risk.	172	1 (<1)	4 (2)	30 (17)	106 (62)	31 (18)	70	3.93 (0.69)	102	3.95 (0.72)	0.230	0.631
I asked my patients which treatment options he/she prefers.	171	1 (<1)	1 (<1)	18 (11)	102 (60)	49 (29)	70	4.13 (0.61)	101	4.17 (0.71)	0.155	0.694
My patient and I thoroughly weighed the different treatment options.	172	1 (<1)	6 (3)	45 (26)	83 (48)	37 (22)	70	3.84 (0.81)	102	3.88 (0.81)	0.003	0.956
My patient and I selected treatment options together.	172	1 (<1)	2 (1)	29 (17)	96 (56)	44 (26)	70	4.07 (0.73)	102	4.03 (0.72)	0.167	0.683
My patient and I reached an agreement on how to proceed.	171	1 (<1)	0 (0)	31 (18)	97 (57)	42 (25)	70	4.11 (0.60)	101	4.00 (0.75)	2.672	0.102

Count data are shown. Percentages are rounded to the nearest percentage point. Percentages may not add up to 100% because of rounding. *Adapted from Scholl et al. (23). Statements prefaced by: "Thinking about your most recent visit with a patient at high CV risk and where you discussed CV risk factors, for each of the following statements, please mark one box that best describes your experience."

TABLE 4. PCP Attitudes on Addressing Patients With High CV Risk at a Recent Office Visit With Regard to Clinic Resources and Current EMR-Driven CDS: Full Sample and Subgroup Differences

Survey Questions	n	Full Sample					Subgroup Comparison					
		Response Options					Rural PCPs		Non-Rural PCPs		Difference	
		Strongly Disagree, n (%)	Disagree or Somewhat Disagree, n (%)	Neither Disagree nor Agree, n (%)	Agree or Somewhat Agree, n (%)	Strongly Agree, n (%)	n	Mean (SD)	n	Mean (SD)	χ ²	P
Clinic resources*												
Our resources (personnel, financial) are too tightly limited to improve CV risk factor care.	171	12 (7)	44 (26)	53 (31)	48 (28)	14 (8)	70	2.89 (1.04)	101	3.16 (1.08)	2.008	0.156
Our clinic visit time is often too short to discuss CV risk factor care.	172	4 (2)	22 (13)	28 (16)	69 (40)	49 (28)	70	3.81 (1.05)	102	3.78 (1.08)	0.437	0.509
Current EMR-driven CDSt												
I would like to use our EMR decision support more often to help better manage a patient's CV risk.	166	1 (<1)	10 (6)	25 (15)	78 (47)	52 (31)	69	4.09 (0.95)	97	3.98 (0.82)	0.000	0.989
Our EMR decision support is unnecessarily complex for helping me manage a patient's CV risk.	165	11 (7)	39 (24)	55 (33)	46 (28)	14 (8)	69	3.00 (1.04)	96	3.14 (1.07)	0.128	0.720
Our EMR decision support is easy to use for helping me manage a patient's CV risk.	166	13 (8)	40 (24)	54 (33)	50 (30)	9 (5)	69	2.96 (1.02)	97	3.05 (1.05)	0.025	0.876
I would need assistance to be able to use our EMR decision support to help me manage a patient's CV risk.	165	20 (12)	33 (20)	40 (24)	55 (33)	17 (10)	68	3.09 (1.17)	97	3.10 (1.22)	0.011	0.917
The various functions in our EMR decision support are well integrated for helping to manage a patient's CV risk.	165	11 (7)	44 (27)	67 (41)	37 (22)	6 (4)	69	2.91 (0.92)	96	2.89 (0.97)	0.000	0.995
There is too much inconsistency in our EMR's decision support ability to help manage a patient's CV risk.	165	6 (4)	35 (21)	95 (58)	24 (15)	5 (3)	68	2.93 (0.78)	97	2.92 (0.80)	0.156	0.693
Most providers can learn to use our EMR decision support very quickly to help them manage a patient's CV risk.	164	7 (4)	21 (13)	65 (40)	59 (36)	12 (7)	68	3.19 (0.90)	96	3.36 (0.95)	0.020	0.888
Our EMR decision support is very cumbersome/awkward to use for helping manage a patient's CV risk.	165	10 (6)	34 (21)	66 (40)	44 (27)	11 (7)	69	3.13 (0.98)	96	3.03 (1.00)	0.448	0.503

TABLE CONTINUED ON P. 290 →

TABLE 4. PCP Attitudes on Addressing Patients With High CV Risk at a Recent Office Visit With Regard to Clinic Resources and Current EMR-Driven CDS: Full Sample and Subgroup Differences, continued from p. 289

Survey Questions	n	Full Sample					Subgroup Comparison			χ ²	P	
		Response Options					Rural PCPs		Non-Rural PCPs			
		Strongly Disagree, n (%)	Disagree or Somewhat Disagree, n (%)	Neither Disagree nor Agree, n (%)	Agree or Somewhat Agree, n (%)	Strongly Agree, n (%)	n	Mean (SD)	n	Mean (SD)		
I feel confident using our EMR decision support to help manage a patient's CV risk.	166	12 (7)	32 (19)	55 (33)	56 (34)	11 (7)	69	3.19 (0.96)	97	3.09 (1.09)	0.136	0.712
I need to learn a lot of things before I could use our EMR decision support to help manage a patient's CV risk.	165	20 (12)	43 (26)	48 (29)	42 (25)	12 (7)	68	2.97 (1.13)	97	2.85 (1.14)	0.856	0.355

*Count data are shown. Percentages are rounded to the nearest percentage point. Percentages may not add up to 100% because of rounding. *Response options included "Disagree" and "Agree" in place of "Somewhat Disagree" and "Somewhat Agree." Statements prefaced by: "Please respond to the following statements about care for patients at high risk of cardiovascular disease and diabetes in your clinic..." †Adapted from the SUS (24). Response options included "Somewhat Disagree" and "Somewhat Agree" in place of "Disagree" and "Agree." Statements prefaced by: "For each of the following statements, mark one box that best describes your reactions to your EMR's ability to help assess and manage the cardiovascular risk (CV risk) of patients at high risk for diabetes or cardiovascular disease."*

suggest opportunities for improving and investing more in clinic resources and EMR-driven CDS for CV risk assessment and management within a large integrated primary care system.

We observed a few statistically significant, albeit clinically marginal, differences between rural and non-rural health care system PCPs. Non-rural PCPs were slightly more likely than rural PCPs to discuss CV risk reduction and diabetes prevention with their patients, be prepared to discuss dietary and physical activity recommendations, and give more importance to screening for prediabetes. The effect of level of rurality may be weak. In addition, differences between rural and non-rural practitioners, including across this integrated health care system, may be small or nonexistent in the studied topic areas. Moreover, state-level initiatives, such as MN Community Measurement, establish common quality standards for health care systems to meet in areas such as diabetes and vascular health (27), which may account for the clinically marginal differences in PCP beliefs and attitudes based on level of clinic rurality, particularly when these quality standards are extended throughout the multistate health care system. Essentia Health's three regions spanning four northern Midwestern states have been rebranded as three markets under "One Mission, One Essentia," with common quality measures and goals. Future research could make comparisons between the effectiveness of various statewide initiatives on prediabetes and CV risk management in primary care.

Although PCPs in this health care system report high interest in CV disease and diabetes prevention, barriers to providing desired care clearly exist. As PCPs attempt to improve care for patients, time constraints may continue to impede patient-centered care. CDS tools and systems that use algorithms to automate typically manual EMR actions have been shown to reduce time spent by providers gath-

TABLE 5. PCP Perceptions of the Diabetes Prevention and CV Risk Factor Reduction Strategies Used by the Clinic: Full Sample and Subgroup Differences

Survey Questions	n	Full Sample		Subgroup Comparison						
		Response Options		Rural PCPs		Non-Rural PCPs		Difference		
		No (0), n (%)	Yes, Worked Well (1), n (%)	Yes, Did Not Work Well/Needs Improvement (2), n (%)	n	Mean (SD)	n	Mean (SD)	χ^2	P
"Has your clinic used the following strategies to implement improved CV risk factor care?"**										
Provided information and skills training to staff related to improved CV risk factor care	159	106 (67)	45 (28)	8 (5)	66	0.33 (0.54)	93	0.42 (0.61)	1.096	0.578
Used periodic measurement of CV risk factor outcomes for the purpose of assessing compliance with the new approach to CV risk factor care	159	83 (52)	51 (32)	25 (16)	67	0.61 (0.74)	92	0.65 (0.75)	0.118	0.943
Reported measurements of provider or clinic performance for CV risk factor outcomes	158	41 (26)	71 (45)	46 (29)	66	0.098 (0.79)	92	1.07 (0.71)	2.816	0.245
Customized the implementation of CV risk factor care changes to each site of care	159	129 (81)	25 (16)	5 (3)	67	0.18 (0.39)	92	0.25 (0.55)	4.007	0.135
Deliberately designed CV risk factor care improvement processes that make physician participation more efficient	155	119 (77)	29 (19)	7 (5)	66	0.30 (0.61)	89	0.26 (0.49)	3.164	0.206
Deliberately designed CV risk factor care processes and tools that make the CV care more beneficial to the patient	158	114 (72)	36 (23)	8 (5)	67	0.33 (0.56)	91	0.33 (0.58)	0.144	0.930
"What components of care management are routinely provided to your patients at high risk of developing diabetes or cardiovascular disease?"†										
Pre-visit planning to assure that all needed information is available at the visit (e.g., consult reports, prior lab results)	149	90 (60)	34 (23)	25 (17)	61	0.57 (0.76)	88	0.56 (0.77)	0.184	0.912
After-visit follow-up for suboptimal CV risk factors and behaviors (by a nurse or care manager)	148	113 (76)	19 (13)	16 (11)	61	0.26 (0.55)	87	0.40 (0.74)	4.429	0.109
Review and individualize the care management plan with patients	146	69 (47)	43 (29)	34 (23)	61	0.67 (0.77)	85	0.82 (0.83)	1.626	0.444
Help patients set individualized treatment goals	145	62 (43)	40 (28)	43 (30)	61	0.75 (0.77)	84	0.95 (0.89)	6.339	0.042*
Review the patient's history of targeted clinical measurements over time (e.g., blood pressure, LDL, A1C, weight)	147	21 (14)	85 (58)	41 (28)	61	1.16 (0.61)	86	1.12 (0.66)	0.721	0.697
Individualized patient education and support	148	66 (45)	45 (30)	37 (25)	61	0.82 (0.79)	87	0.79 (0.84)	1.571	0.456

TABLE CONTINUED ON P. 292 →

TABLE 5. PCP Perceptions of the Diabetes Prevention and CV Risk Factor Reduction Strategies Used by the Clinic: Full Sample and Subgroup Differences, continued from p. 291

Survey Questions	n	Full Sample				Subgroup Comparison				
		Response Options		Rural PCPs		Non-Rural PCPs		Difference	P	
		No (0), n (%)	Yes, Worked Well (1), n (%)	Yes, Did Not Work Well/Needs Improvement (2), n (%)	n	Mean (SD)	n			Mean (SD)
Closely monitor patients' response and adherence to the care plan for managing suboptimal CV risk factors and behaviors	146	85 (58)	35 (24)	26 (18)	60	0.63 (0.78)	86	0.57 (0.78)	0.505	0.777
Follow up when patients have not kept important appointments	148	76 (51)	31 (21)	41 (28)	61	0.72 (0.84)	87	0.79 (0.88)	0.587	0.746
"Does your clinic have a system in place to ensure that patients at high risk of developing diabetes or cardiovascular disease have each of the following occur?"†										
Receive specific diagnoses for prediabetes (i.e., diagnostic codes).	147	78 (53)	56 (38)	13 (9)	61	0.48 (0.60)	86	0.62 (0.69)	2.187	0.335
Add prediabetes to the problem list.	147	76 (52)	50 (34)	21 (14)	61	0.62 (0.73)	86	0.63 (0.72)	0.074	0.964
Receive treatment intensification for suboptimal CV risk factor control.	146	91 (62)	35 (24)	20 (14)	61	0.51 (0.74)	85	0.52 (0.72)	0.438	0.803
"Does your clinic use the following for managing cardiovascular risk factors in patients at high risk for diabetes or cardiovascular disease?"**										
Checklists of tests, medications, or referrals that are needed for prevention or monitoring of CV risk factors.	156	99 (63)	35 (22)	22 (14)	65	0.58 (0.75)	91	0.45 (0.72)	2.253	0.324
Guideline-driven reminders for services the patient should receive that appear when seeing the patient.	155	59 (38)	53 (34)	43 (28)	65	0.95 (0.78)	90	0.86 (0.83)	2.079	0.354
A systematic approach to identify and remind patients with high risk of diabetes or cardiovascular disease who are due for health services.	155	68 (44)	59 (38)	28 (18)	65	0.71 (0.77)	90	0.77 (0.74)	0.906	0.636
"Does your clinic routinely use the following activities to encourage patient self-management?"†										
Developing individualized self-management plans with goals.	147	91 (62)	27 (18)	29 (20)	61	0.54 (0.79)	86	0.60 (0.82)	0.228	0.892
Providing written materials that explain to the patient the recommended medical care guidelines for the conditions and risk factors.	146	77 (53)	33 (23)	36 (25)	60	0.60 (0.79)	86	0.80 (0.87)	2.281	0.320

*P <0.05. Count data are shown. Percentages are rounded to the nearest percentage point. Percentages may not add up to 100% because of rounding. **"Yes" respondents were asked, "How well did this strategy work?" Response options included: "Worked/works well" and "Did not work well." †"Yes" respondents were asked, "How well does this strategy work?" Response options included: "Works well" and "Needs improvement."

ering data from patients' EMRs (28), as well as increase clinicians' screening, prevention, treatment, and clinical testing of CV disease (29). CDS can also support the chronic care model by maximizing EMR utility in primary care, incorporating evidence-driven guidelines into care recommendations, and facilitating informed patient and provider shared decision-making (15,16,30). Of note, most PCP respondents in this study who used CV risk calculators reported doing so through the EMR. This result suggests the viability of expanding the capability of the EMR to provide more value through identification and prioritization of treatment recommendations for the prevention of diabetes and CV disease (31,32).

Limitations to this study include the potential effects of nonresponse bias and social desirability inherent in survey methods. However, our broad inclusion criteria (PCPs practicing in 36 Essentia Health primary care clinics who saw patients at least 1 day per week), high response rate, and confidential data collection helped mitigate these issues. An additional limitation is that our constructed dichotomous variable representing level of PCP clinic rurality (rural or non-rural), created based on clinic RUCA codes, could be constructed differently by other researchers. Moreover, opportunities to improve diabetes prevention and CV risk reduction in primary care exist aside from the EMR-driven decision support tools focused on in this survey. Lastly, generalizability is limited to other PCPs in the Essentia Health system, although a further limitation is that only PCPs practicing in the 36 study clinics were included in the survey. The research team will be conducting post-intervention PCP surveys in future years, as well as reviewing patient EMR data regarding CV risk assessment and diabetes prevention outcomes in relation to the EMR-based CDS CV risk assessment tool being tested in study

intervention clinics, making comparisons with control clinics. Future articles will report these findings.

A considerable number of adults in the United States have prediabetes and high CV risk. However, many are unaware of either this health risk or the options for preventing future disease and complications. PCPs believe that diabetes and CV disease prevention is important, but are working within limited time constraints. They perceive a need for better EMR-driven CDS tools and resources to improve the quality of preventive care delivered within the primary care setting.

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Duality of Interest

No potential conflicts of interest relevant to this article were reported.

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Author Contributions

M.L.H. wrote the manuscript and analyzed the data. M.L.H., D.M.S., and J.R.D. determined the analysis plan. D.M.S. and J.R.D. designed the study and contributed to the manuscript. C.I.A., K.A.O., J.M.S.-H., P.J.O., J.Y.Z., and S.P.D. reviewed and edited the manuscript. D.M.S. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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